

# **A Numerical Modeling Examination of the Cumulative Physical Effects of Offshore Sand Dredging for Beach Nourishment**

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***Background*** The sand shoals situated along many of the east coast states are being used, or will potentially be used, as sand borrow areas for renourishing or restoring adjacent beaches. Many of these shoals lie in Federal waters. Requests for negotiated agreements to use these areas as sand sources are expected in the near-term. Sandbridge Shoal, offshore Virginia has already been used by the Navy to restore the beach at the Dam Neck site and a negotiated agreement to use the same borrow area to restore Sandbridge Beach is currently in progress. This shoal, as well as other identified sand borrow areas offshore New Jersey, Maryland, Delaware, North Carolina, South Carolina, and Florida are expected to serve as long-term sources of borrow material, owing to the renourishment cycles that are typically called for. This raises the issue as to the cumulative effects of dredging these shoals, particularly in terms of alterations to the local current and wave regime.

Wave energy tends to concentrate behind a shoal because of wave refraction and diffraction. The combination of wave length and shoal geometry controls the response of waves as they interact with a shoal. Shoal responses may also depend on the shoal size and ambient water depth as well as the wave conditions. The MMS-funded Virginia coast study has found that Sandbridge Shoal does have the effect of concentrating wave energy for the waves that comes from north-northeast.

When a shoal is flattened (by dredging), the degree of wave energy concentration is likely to be reduced, resulting in greater wave energies hitting the coastal area. This may result in increased coastal erosion or unwanted, detrimental changes in longshore or nearshore current patterns. Significant coastal impacts could also be expected during storm events in that increased wave energies which might have been somewhat dissipated by the presence of the shoal would now impact the coastal area with greater forces.

***Objective*** The objective of the study is to examine the potential for negative impacts to the coastal and nearshore area due to long-term dredging and significant removal of sand from the Federal shoals identified as potential borrow sites on the east coast of the U.S. offshore the states of New Jersey, Maryland, Delaware, Virginia, North and South Carolina, and Florida.

***Methods*** The study is using an existing off-the-shelf numerical wave refraction/diffraction model to study shoal response relative to wave energies, both normal and storm-induced, assuming that significant amounts of sand have been removed during several dredging episodes. As an example, one of the model scenarios might assume that 1/3 of the shoal has been removed over a number of years and renourishment cycles. More aggressive scenarios will also be tested.